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BACKLIGHT FOR A LIQUID CRYSTAL DISPLAY DEVICE
[EKISHO HYOJI SOUCHI NO BACKLIGHT]

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[Claims]

1. A backlight for a liquid crystal display device, comprising:

a light source; and

a light guide plate that irradiates light from the backside of a liquid crystal display panel using multiple-reflected light from the light source as an area light source,

wherein said light guide plate comprises:

a flat lighting surface that is rectangular and is parallel to said liquid crystal display panel; and

a back surface that has a groove that is formed at the center of the short sides of the rectangular shape being parallel to the long sides, and is formed to have gradually larger thickness towards the two edges on the long sides across said groove,

and said light source is inserted in said groove.

2. The backlight for a liquid crystal device according to Claim 1, wherein said light source is a fluorescent tube.

[Detailed Description of the Invention]

[0001]

[Applicable Industrial Field]

The present invention relates to a backlight for a liquid crystal display device.

[0002]

[Prior Art]

As shown in Fig. 3, a most common conventional backlight for a liquid crystal display device (hereinafter referred to as “a backlight”) includes fluorescent tubes [12] parallel to the two edges of a double flat sided light guide plate [31] and irradiates light onto a liquid crystal display panel [22] from the backside through a diffusion plate [23]. Since the thickness of the whole liquid crystal display can be reduced by this side lighting method in comparison with a lighting method that lights directly above the light source, a side lighting method has been more recognized. Furthermore, in order to reduce power consumption, there is an example of providing a fluorescent tube only on one end face, but in this case, the irradiation of light onto a liquid crystal panel decrease by half. As a means to solve this drawback, Japanese Unexamined Patent Application Publication H3-107821

suggests a backlight in which a fluorescent tube is disposed in the center part of a light guide plate. As shown in Fig. 4, forming a groove [14] by boring the center part of the double flat-sided light guide plate [41] and disposing one florescent tube [12] in the groove, this liquid crystal display device can prevent the decrease of irradiation of the light and achieve equivalent illuminance to that of a backlight in which a fluorescent tube is disposed on the both end surfaces of the light guide plate [31] shown in Fig. 3. Furthermore, in this structure, since the surface of the light guide plate is flat, if an electrical circuit board [21] is disposed, the thickness of the light guide plate [41] is thereby increased, so that there is limitation in reducing the thickness of the liquid crystal display device.

[0003]

[Problems to be Solved by the Invention]

In the conventional backlight, since a fluorescent tube is disposed on the both end surfaces of the light guide plate, the cost of components is doubled and the power consumption is also doubled, in comparison with when one fluorescent tube is used. In addition, even the width W_2 in Fig. 3 has to be larger for the diameters of the two fluorescent tubes.

[0004]

On the other hand, in case of a backlight in which a fluorescent is disposed in the groove provided in the center of the light guide plate, which is shown in Fig. 4, while the width W_1 is smaller than W_2 because of the diameters of the two fluorescent tubes, the thickness T_2 is total of the thickness of the light guide plate and the thickness of the electric circuit board, so that there is another problem of having limitation in reducing the thickness of the liquid crystal display device.

[0005]

An object of the invention is to provide a backlight for a liquid crystal display device, which is inexpensive and consumes less power and whereby miniaturization and weight reduction of the liquid crystal display device can be achieved.

[0006]

[Means to Solve the Invention]

The present invention is a backlight for a liquid crystal display device, which includes a light source and a light guide plate that irradiates light from the backside of a liquid crystal display panel using multiple-reflected light from the light source as an area light source. The light guide plate includes a flat lighting surface that is

rectangular and is parallel to said liquid crystal display panel; and a back surface that has a groove formed at the center of the short sides of the rectangular shape being parallel to the long sides and is formed to have gradually larger thickness towards the two edges on the long sides across the groove, and the light source is inserted in the above-described groove.

[0007]

[Embodiment(s)]

Referring now to the drawings, an embodiment of the invention will be described.

[0008]

Fig. 1 is a perspective view of a light guide plate in an embodiment of the invention. In this embodiment, as shown in Fig. 1, a groove [14] is formed at the center of the short sides of a rectangular light guide plate [11] by boring so as to be parallel to the long sides, the lighting face of the light guide plate [11] is made flat, the flat surfaces that are opposite to the lighting surface are formed so as to have gradually smaller thickness from t_1 to t_2 towards the both edges on the long sides across the groove [14], and a fluorescent tube [12], i.e. a light source, is disposed in the groove [14]. Accordingly, the illuminance equivalent to when a fluorescent tube [12] is

disposed on the two end surfaces of the light guide plate can be achieved and the number of the fluorescent tubes [12] can be reduced to half the number in a conventional backlight, in which the fluorescent tube [12] is disposed on the both end surfaces of the light guide plate [31] as shown in Fig. 3. Therefore, the material fee and the power consumption can be reduced. Furthermore, since the light guide plate is made to be gradually thinner towards the edges on the long sides across the groove [14], the weight can be reduced and thereby even the weight of the liquid crystal display device can be reduced.

[0009]

Fig. 2 is a sectional view of an embodiment of a liquid crystal display device using the light guide plate of Fig. 1. As shown in Fig. 2, the liquid crystal display device in this embodiment includes a liquid crystal display panel [22], the fluorescent tube [12], a backlight including a light guide plate [11] and a diffusion plate [23], and an electronic circuit board [21] that drives the liquid crystal display panel [22] as major elements. If the light guide plate having thickness that is gradually smaller towards the two side face directions of the long sides is mounted in a casing [24], the space between the light guide plate [11] and the bottom face of the casing

[24] becomes gradually wider towards the two edges. Therefore, corresponding to the space, components of the electronic circuit board [21] can be disposed for the respective thicknesses. Accordingly, since the thickness T_1 of the liquid crystal display device can be made smaller than the thickness T_2, miniaturization of the liquid crystal display can be also achieved.

[0010]

[Effects of the Invention]

As described above, in the present invention, a backlight for a liquid crystal display device is configured to include a light guide plate, which has a flat irradiation surface that is rectangular and is parallel to the liquid crystal display panel; a back surface that has a groove formed at the center of the short sides so as to be parallel to the long sides and is formed so as to have thickness that is gradually smaller towards the two edges on the long sides across the groove; and a fluorescent tube inserted in the groove. In addition, components are mounted on an electronic circuit board according to the size of space between the light guide plate and the bottom face of a casing. Therefore, without reducing the irradiation, the thickness and weight of the liquid crystal display device can be reduced and power consumption can be

reduced. For example, if a backlight is composed setting t_1 to 4 mm and t_2 to 0.4 mm, the weight can be reduced to about 0.55 (2.2/4) times and the thickness can be reduced to about 3 mm.

/3

[Brief Description of the Drawings]

Fig. 1 is a perspective view of a light guide plate according to one embodiment of the invention.

Fig. 2 is a sectional view of a liquid crystal display device in one embodiment, using the light guide plate of Fig. 1.

Fig. 3 is a sectional view of an example of a conventional liquid crystal display device.

Fig. 4 is a sectional view of another example of a conventional crystal display device.

[Description of Reference Numerals]

11, 31, 41: Light guide plate

12: Fluorescent tube

13: Lead wire

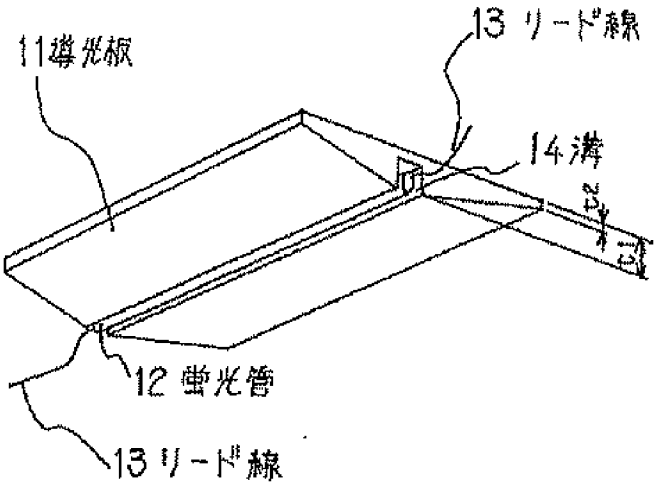
14: Groove

21: Electronic circuit board

22: Liquid crystal display panel

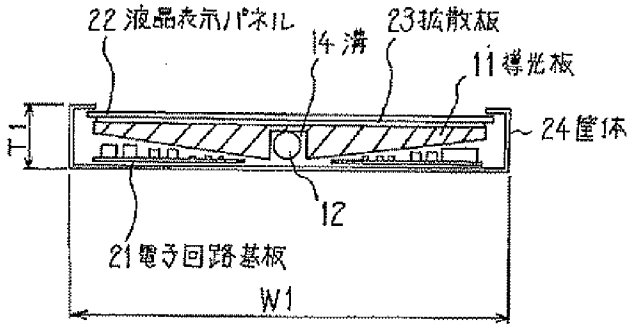
23: Diffusion plate

24: Casing



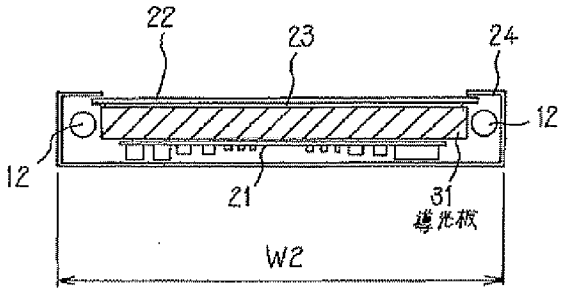
11: Light guide plate
12: Fluorescent tube
13: Lead wire
14: Groove

[Fig. 1]



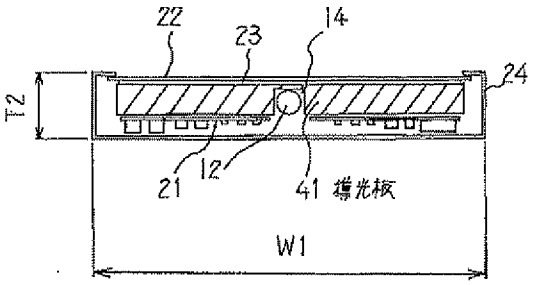
11: Light guide plate
14: Groove
21: Electronic circuit board
22: Liquid crystal display panel
23: Diffusion plate
24: Casing

[Fig. 2]



31: Light guide plate

[Fig. 3]



[Fig. 4]

41: Light guide plate